

AMENDMENTS TO THE CLAIMS

The text of all pending claims, (including withdrawn claims) is set forth below. The following listing of claims replaces all prior versions and listings of claims in the application.

Listing of Claims:

1. (currently amended) A method for dynamically optimizing data throughput at radio interfaces of a packet data cellular network, said interfaces comprising one or more types of modulations having different immunity from transmission errors when used for transmitting bursts of data, said data being packed-up in blocks between mobile stations and serving base station and vice versa, comprising the steps of:

- obtaining for each available modulation at least one of an upgrade and a downgrade tabulated threshold of the Block Error Rate delimiting a range in which the available modulation outperforms other available modulations in terms of net data throughput;

- averaging and comparing the Block Error Rate, substantially continuously, of the relevant temporary connection with the tabulated thresholds for selecting the proper modulation; combining each available modulation with two or more coding schemes thereby obtaining many modulation-and-coding schemes with different protection against transmission errors;

- obtaining for each modulation and coding scheme at least one of a first upgrade and a first downgrade tabulated Block Error Rate threshold which is valid for low-diversity radio frequency channels, delimiting a range in which the modulation and coding scheme outperforms the other available modulation and coding schemes in terms of net data throughput, and considering as low-diversity a channel without frequency hopping and with low user mobility;

- obtaining for each modulation and coding scheme at least one of a second upgrade and a second downgrade tabulated Block Error Rate threshold which is valid for high-diversity radio frequency channels, delimiting a range

in which the modulation and coding scheme outperforms the other available modulation and coding schemes in terms of net data throughput, and considering as high-diversity a channel characterized by frequency hopping or high user mobility;

- selecting either the first or the second tabulated thresholds according to diversity of the radio frequency channel which sustains a temporary connection[[:]]; and

- using the selected thresholds for discriminating a right modulation and coding scheme.

2. (previously presented) The method according to claim 1, wherein the step of discriminating a right modulation and coding scheme further comprises the steps of:

- updating, at each new incoming block of data, an averaged value of Block Error Rate evaluated in correspondence of an actual modulation and coding scheme;

- comparing the averaged Block Error Rate with the at least one of the upgrade and downgrade thresholds of the actual modulation and coding scheme;

- replacing the actual modulation and coding scheme with a modulation and coding scheme immediately less error protected when the averaged Block and Error Rate is lower than the upgrade threshold; or

- replacing the actual modulation and coding scheme with the modulation and coding scheme immediately more error protected when the averaged Block and Error Rate is higher than the downgrade threshold.

3. (previously presented) The method according to claim 1, further comprising the steps of:

- obtaining for each modulation and coding scheme at least one of a third upgrade and third downgrade tabulated Block Error Rate thresholds valid for both low-diversity channels and incremental redundancy active, and

- delimiting a range in which the modulation and coding scheme outperforms the other available modulation and coding schemes in terms of net data throughput.

4. (currently amended) The method according to claim ~~13~~, further comprising the steps of:

- obtaining for each modulation and coding scheme at least one of a fourth upgrade and downgrade tabulated Block Error Rate thresholds valid for both high-diversity channels and incremental redundancy active, and
- delimiting a range in which the modulation and coding scheme outperforms the other available modulation and coding schemes in term of net data throughput.

5. (currently amended) The method according to claim ~~34~~, wherein a receiving entity performs the steps of:

- temporarily storing errored data blocks in a memory buffer for joint decoding with new transmissions of original blocks according to an incremental redundancy technique; and
- continuously checking a condition of buffer full and other causes making retransmission with incremental redundancy inapplicable, for building a status variable which measures an averaged status of the incremental redundancy.

6. (previously presented) The method according to claim 5, wherein for each modulation and coding scheme a linear interpolation is performed run-time between at least one of the first and third upgrade thresholds and between the first and third downgrade thresholds, using the status variable as interpolating factor for unbalancing the entity of the interpolation either towards third thresholds when incremental redundancy prevails, or towards first thresholds in a contrary case.

7. (previously presented) The method according to claim 5, wherein for each modulation and coding scheme a linear interpolation is performed run-time between at least one of the second and fourth upgrade thresholds and between the second and fourth downgrade thresholds, using the status variable as interpolating factor for unbalancing the entity of the interpolation either towards fourth thresholds when incremental redundancy prevails, or towards second thresholds in the contrary case.

8. (currently amended) The method according to claim 5, wherein the averaged status of the incremental redundancy is obtained by:

- weighting both a preceding and an actual values of a variable,
- taking value 1 ~~if~~-when incremental redundancy is properly working, and value 0 for the contrary, and
- using a digital filter having a pulse response exponentially decreasing with discrete time n spanning a data block period.

9. (previously presented) The method according to claim 1, wherein the averaged value of Block Error Rate is obtained by weighting both preceding values of Block Error Rate and actual decisions on errored blocks, using a digital filter having a pulse response exponentially decreasing with discrete time n spanning a block period.

10. (previously presented) The method according to claim 9, wherein the pulse response of the digital filter of Block Error Rate is obtained by summing two weight functions both accepting samples with a commanded modulation and coding scheme, a first one to weigh the preceding values of Block Error Rate and the second one to weigh the actual decisions on errored blocks.

11. (previously presented) The method according to claim 10, wherein the first and second weight functions have balanced weights, so that an arbitrary increasing of a weight of the first function also involves an equal decreasing of the weight of the second function, and vice versa.

12. (previously presented) The method according to claim 11, wherein the weight of the first and second weight functions are both equally varied in order to compensate a missing filtering effect of possible lacking blocks, in that making an outlined pulse response possible.

13. (previously presented) The method according to claim 12, wherein the first and second weights are carried out by making the first and second weight functions further depending on a reliability function which tracks an age of the received blocks.

14. (currently amended) The method according to claim 10, wherein the temporary connection is dedicated to transfer packet data from a selected mobile station to the base station, and the pulse response of Block Error Rate digital filter is obtained according to the function:

$$BLER_n = f_1(BLER_{n-1}) + f_2(s_n)$$

wherein:

- n is an iteration index, spanning one block period;
- $s_n = 0$ ~~if~~ when a block at instant n has been correctly received;
- $s_n = 1$ ~~if~~ when a block at instant n has not been correctly received;
- $s_n = \frac{1}{K} \sum_{k=1}^K s_{n,k}$ ~~if~~ when K blocks are received for a considered

connection;

- $f_1(BLER_{n-1})$ is the first weight function, taking values inside an interval 0 - 1; and
- $f_2(s_n)$ is the second weight function of the variable s_n relative to a decision on the errored blocks, taking values inside the interval 0 - 1.

15. (currently amended) The method according to claim 14, wherein the first and second weight functions comprise the following expressions:

$$f_1(BLER_{n-1}) = (1 - \beta \cdot \frac{X_n}{R_n}) \cdot BLER_{n-1}$$

$$f_2(s_n) = \beta \cdot \frac{X_n}{R_n} \cdot s_n$$

wherein:

- x_n is equal to 1 if when “at least” one ~~RLC~~ Radio Link Control (RLC) block for a considered connection with a commanded MCS is received at time instant n , otherwise is set to 0;
- $\beta = 1/T_{AVG}$ is a forgetting factor and T_{AVG} being a filtering period in multiples of a radio block; and
- $R_n = (1-\beta) \cdot R_{n-1} + \beta \cdot x_n$; $R_{-1} = 0$ is said reliability function.

16. (previously presented) The method according to claim 8, wherein the temporary connection is dedicated to transfer packet data from a selected mobile station to the base station, and said pulse response of the digital filter of the status variable is obtained according to the following function:

$$IR_status_n = f_1(IR_status_{n-1}) + f_2(IR_check_n)$$

wherein:

- n is an iteration index spanning one block period; and
- f_1 and f_2 are weight functions according to same laws as used in the Block Error Rate calculation.

17. (previously presented) The method according to claim 16, wherein the first and second weight functions comprise the following expressions:

$$f_1(IR_status_{n-1}) = (1 - \beta \cdot \frac{x_n}{R_n}) \cdot IR_status_{n-1}$$

$$f_2(IR_check_n) = \beta \cdot \frac{x_n}{R_n} \cdot IR_check_n$$

wherein: R_n takes a formal expression as that used in the Block Error Rate calculation, while x_n and β are the same.

18. (currently amended) The method according to claim 67, wherein the linear interpolations comprise the following expressions:

$$UP_th_n = (1 - IR_status_n) \times BLER_{MCSx \rightarrow MCSy} + IR_status_n \times BLER_{MCSx_wIR \rightarrow MCSy_wIR}$$

$$DN_th_n = (1 - IR_status_n) \times BLER_{MCSx \rightarrow MCSz} + IR_status_n \times BLER_{MCSx_wIR \rightarrow MCSz_wIR}$$

wherein:

- UP_th_n and DN_th_n are an upgrade and downgrade thresholds, respectively, at an n-th block period;
- $BLER_{MCSx \rightarrow MCSy}$ is an upgrade first (A) or second (B) tabulated threshold;
- $BLER_{MCSx_wIR \rightarrow MCSy_wIR}$ is an upgrade third (C) or fourth (D) tabulated threshold;
- $BLER_{MCSx \rightarrow MCSz}$ is a downgrade first (A) or second (B) tabulated threshold;
- $BLER_{MCSx_wIR \rightarrow MCSz_wIR}$ is a downgrade third (C) or fourth (D) tabulated threshold.

19. (previously presented) The method according to claim 10, wherein the temporary connection is dedicated to transfer packet data from the base station to a selected mobile station, and the pulse response of Block Error Rate digital filter is obtained according to the following function:

$$BLER_k = f_1(BLER_{k-1}) + f_2(s_k)$$

wherein:

- k is a reporting instant lasting m blocks;

- $s_k = \frac{\text{Nack_blocks}}{\text{Sent_blocks}}$

Nack_blocks: number of badly received blocks among those sent with a present MCS;

Sent_blocks: number of blocks sent with a present MCS in a previous polling period:

- $f_1(BLER_{k-1})$ is the first weight function, taking values inside an interval 0 - 1; and
- $f_2(s_k)$ is the second weight function of the variable s_k relative to the decision on the errored blocks, taking values inside the interval 0 - 1.

20. (previously presented) The method according to claim 19, wherein the first and second weight functions comprise the following expressions:

$$f_1(BLER_{k-1}) = (1 - \frac{\beta}{R_k}) \cdot BLER_{k-1}$$

$$f_2(s_k) = \frac{\beta}{R_k} \cdot s_k$$

wherein:

- $\beta = 1/T_{AVG}$ is a forgetting factor and T_{AVG} being a filtering period in multiples of a radio block; and
- $R_k = (1-\beta)^m \cdot R_{k-1} + \beta$; $R_{-1} = 0$ is said reliability function.

21. (currently amended) The method according to claim 19, wherein the temporary connection is dedicated to transfer packet data from the base station to a selected mobile station, and the pulse response of the status variable digital filter is obtained according to the following function:

$$IR_status_k = f_1(IR_status_{k-1}) + f_2(IR_check_k)$$

wherein:

- k is a reporting instant lasting m blocks;
- f_1 and f_2 are weight functions following the same laws as used in the Block Error Rate calculation.

22. (currently amended) The method according to claim 21, wherein the first and second weight functions comprise the following expressions:

$$f_1(IR_status_{k-1}) = \left(1 - \frac{\beta}{R_k}\right) \cdot IR_status_{k-1}$$

$$f_2(IR_check_k) = \frac{\beta}{R_k} \cdot IR_check_k$$

wherein: R_k takes a formal expression as that used in the Block Error Rate calculation, and β is the same.

23. (previously presented) The method according to claim 1, wherein a modified power control works in parallel with the modulation and coding scheme switching link adaptation and the modified power control includes the following steps:

– off-line calculation of the expression:

$$T_{PXTS} = T_P / N_{TS},$$

wherein: $T_{P \times TS}$ is a Peak Throughput per timeslot; T_P is a Peak Throughput derived from a Quality of Service Class of the connection, and N_{TS} is a minimum between a number of allocable timeslots and a number of timeslots that can be handled by the mobile station due to its multislot class;

- off-line mapping of the calculated $T_{P \times TS}$ on a simulated curve depicting a maximum achievable net throughput in function of values of Carrier versus Interference C/I , and obtaining from the curve a target C/I_{target} value; and

- exploiting the C/I_{target} for all duration of the ongoing connection as a goal to be maintained by the network exploiting the Power and Interference measures at a receiver side.